HAGERMAN FOSSIL BEDS NATIONAL MONUMENT
GEOLOGIC RESOURCES EVALUATION
SCOPING MEETING SUMMARY

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Executive Summary

In a Geologic Resources Evaluation scoping meeting held at the headquarters of Hagerman Fossil Beds National Monument in Hagerman, Idaho, September 18, 2003, scoping meeting participants identified the following geologic resources management issues.

1. Landslide activity presents a human health and safety hazard as well as confirmed destruction of fossil sites.

2. Paleontological resources have not been adequately inventoried and are being threatened by loss, mainly from landslides and erosion of poorly consolidated sediments of the Glenns Ferry Formation.

3. Groundwater activity facilitates the increasing landslide activity and the associated destruction of fossil localities. It also contributes to non-native vegetation growth.

4. Wind erosion, though a natural process, has significant adverse impacts on fossil sites. While exposing new fossils for collection it also displaces, reburies, and/or destroys them relatively quickly.

5. Mineral issues: There has been some placer mining for gold along the Snake River. There apparently are deposits of uranium and radium, which has preferentially been taken-up by fossil material. There has never been a complete and systematic study of the mineralogy of any of the geologic formations at HAFO

Introduction

The National Park Service held a Geologic Resources Evaluation scoping meeting at the headquarters of Hagerman Fossil Beds National Monument (HAFO) on Thursday, September 18, 2003. The purpose of the meeting was to discuss the status of geologic mapping in the park, the associated bibliography, and the geologic issues in the park. The products to be derived from the scoping meeting are: (1) Digitized geologic maps covering the park; (2) An updated and verified bibliography; (3) Scoping summary (this report); and (4) A Geologic Resources Evaluation Report which brings together all of these products.

Hagerman Fossil Beds NM was established on November 18, 1988 by Title III of Public Law 100-696 (102 Stat. 4575). The national monument was established to "preserve …the outstanding paleontological sites known as the Hagerman Valley fossil sites, to provide a center for continuing paleontological research, and to provide for the display and interpretation of the scientific specimens uncovered at such sites…" The Monument has a total of 4,351 acres, almost entirely lying on the west side of the Snake River.

Hagerman Fossil Beds National Monument lies entirely within the Hagerman 7.5-minute topographic quadrangle. However, there are four additional quads of interest: Bliss, Indian Butte, Yahoo Creek and Tuttle. Malde, *et. al.* (1963), produced a geologic map of the west-central Snake River plain at a scale of 1:125,000. Malde and Powers (1972) published a geologic map of the Glenns Ferry-Hagerman area at a scale of 1:48,000. The Idaho Geological Survey (IGS) is in the process of converting this map to the most recent USGS topographic base at a scale of 1:24,000. The final product will be in CAD format but can be converted to ESRI formats. The map will include all data layers and metadata. The IGS is planning to update the stratigraphic nomenclature to currently acceptable unit names as well. Chleborad and Powers (1996) produced a slope map at a scale of 1:24,000. A soils map of the park has been digitized. There is a need expressed by the park for large scale maps of the landslide areas and of fossil sites.

Physiography

Hagerman Fossil Bed NM lies on the boundary between the Eastern Snake River plain and the Western Snake River plain. The Snake River plain is an arc-shaped topographic basin extending about 400 miles and trending generally east-west. Width of the plain varies from about 50 miles to about 125 miles toward the east. (Maley, 1987). To the east, the plain ends in the Yellowstone Plateau, and on the west, it merges with the Columbia Plateau. The Western Snake River plain is bound on the south by the Owhyee Plateau, composed of Cretaceous granitic rocks and Tertiary volcanic rock, and on the north by the Idaho Batholith. The eastern section cuts across Basin and Range topography. The Snake River Plain has little topographic relief and is topographically uniform. Elevations range from about 6,500 feet on the extreme east end to about 2200 feet at the Oregon-Idaho border.

The monument lies almost entirely on the west side of the Snake River on arid, dissected slopes that are truncated by the Snake River, forming bluffs along the west bank. The bluffs rise about 650 feet above the river from 2800 feet elevation at the water surface to about 3450 feet at the top of the slopes. To the west of the monument is the relatively flat Bruneau Plateau. On the east side of the river is the Hagerman Valley and the town of Hagerman.

Geology

Unlike the eastern Snake River plain which is dominated by lava flows, the western portion, especially in the Hagerman area, is characterized by terrigenous sediments, mostly lake deposits, with a few thin basaltic stringers. The most of the sedimentary sequence is divided into the Idaho Group and the Snake River Group. The Idaho Group is underlain by the Idavada Volcanics, composed of silicic latite, forming thick layers of welded tuff and lava flows, and rhyolitic tuffs. This rhyolitic volcanism, associated with the Yellowstone-Snake River plain hotspot, deposited the volcanics in southwestern and south-central Idaho during the middle Miocene, about 14 to 9 MA (Malde and Powers, 1962). The combined thickness of these layers may be over 2,000 feet. (Malde & Powers, 1972). The Idavada Volcanics are not exposed in the monument.

The Idaho Group has been divided into seven formations ranging in age from 11 million years to about 700,000 years old (Middle Miocene to Pleistocene). From oldest to youngest these formations are: Poison Creek Formation, interbedded with the Banbury Basalt; Chalk Hills Formation; Glenns Ferry Formation; Tuana Gravel; Bruneau Formation; and, Black Mesa Gravel. The Idaho Group are mostly lacustrine and associated deposits from Lake Idaho: lake, flood plain and alluvium; interbedded with lava flows. Only the Glenns Ferry Formation and younger deposits are exposed in the monument.

The Glenns Ferry Formation lies unconformably on the Chalk Hills Formation and the Banbury Basalt at some localities. The age of the Glenns Ferry Formation is generally from about 5 to 1.5 MA (Pliocene to early Pleistocene; Malde, 1991). Malde and Powers (1972) describes the Glenns Ferry as "lake and stream deposits characterized by abrupt changes in facies." Some of these facies include massive silt, thick-bedded sands, thin bedded "dark clay, olive silt, and carbonaceous shale," sand and silt showing ripple marks, "granitic sand and fine pebble gravel…and quartzitic cobble gravel." Malde and Powers (1972) also show two lava flows exposed in the monument: Clover Creek lava flow (fine-grained plagioclase-olivine basalt), and Shoestring Road lava flow (coarse-grained porphyritic plagioclase-olivine basalt).

Tuana Gravel (Pleistocene) rests unconformably on the Glenns Ferry and is exposed mainly on the plateau to the west of the monument and east to the slope break inside the west boundary of HAFO. The Tuana is composed of pebble and cobble gravels with layers of massive brown to gray sand and silt (Malde and Powers, 1972). Thickness ranges from about 200 feet at Indian Butte, south of HAFO, to about 50 feet at the north end (Bjork, 1968; Malde and Powers, 1972). A dense, hard caliche layer has formed several feet below the surface on the tops of the bluffs. This layer forms a cap rock in most of the monument and the surrounding area (Farmer and Riedel, 2003)

The Bruneau Formation (Pleistocene) occurs in localized areas in the monument and more extensively immediately to the south. Malde and Powers (1972) describes the Bruneau as massive lake beds of fine silt, clay, and diatomite. Near the south end of HAFO, are exposures of the Pleistocene Crowsnest Gravel (Snake River Group), composed of silicic volcanic pebbles and terrace deposits. The Black Mesa Gravel is not exposed in the monument. They also map occurrences of alluvial pebble and cobble gravels, stream alluvium, and landslide debris (Pleistocene to Holocene). Landsliding continues to occur to the present.

Significant Geologic Resource Management Issues in Hagerman Fossil Beds National Monument

1. Landslide Activity

The two most significant geologic issues in Hagerman are the presence of fossils and the active landsliding, which heavily impacts the occurrence and recovery of the fossils. Landsliding is a function of lack of consolidation of sediment, steep slopes, and the flow of groundwater. The first two are geological conditions beyond human control. However, the groundwater regime has been greatly modified by the influx of agricultural irrigation water from the plateau to the west of HAFO. Seven major slides related to irrigation have occurred in the last 25 years: ca. 1979, 1983, 1987, 1989, 1991, 1995, and 2004. Also, two other locations adjacent HAFO on property managed by the Bureau of Land Management (BLM) failed in 1993 and 1997. (Farmer and Riedel, 2003).

The frequency and order of magnitude of landsliding appears to be increasing. There is a need to distinguish the contribution of water from precipitation versus that from agriculture. Continued monitoring needs to be done on groundwater influx and movement – rates, frequency, and duration - with direct supervision by the park hydrologist to ensure seamless integration into existing hydrologic program management. Monitoring water quality is needed including: sediment load, nutrients (phosphates, nitrates), temperature, discharge rates, water balance, and effects of water influx on fish hatcheries. How much slump material has moved into the Snake River? Is this resulting in the siltation of downstream dams? How much water is lost from ditches and canal and how does it impact the groundwater regime? Research needs include: hydrologic modeling, dye tracer tests, paleo-landslide studies, flow rates of springs, and topographic mapping of the river bottom.

2. Protection and Preservation of Paleontological Resources

HAFO was established, in part, to preserve and protect paleontological resources. It is one of the premier fossil sites in the National Park System and the richest Pliocene-aged fossil locality in the world. Yet, fossils are being destroyed and fossil sites are being obliterated by landsliding, slumping, erosion, weathering, wind action, and theft. There is a need to relocate previously known fossil sites and locate and preserve new sites using GPS and photographic documentation. Photographic monitoring is needed to document changes in vegetation due to grazing, irrigation, and the introduction of exotics. However, fossil researchers are at risk due to the instability of the bluffs, making inventory, monitoring, and research more difficult and dangerous. Future actions need to be closely supervised by the park paleontologist to ensure seamless integration into the existing fossil resource management program at the park.

3. Groundwater Use

The Bell Rapids Irrigation District has been pumping water out of the Snake River up to the Bruneau Plateau sine about 1970. The increased influx of this water has not only precipitated increased landsliding (see above), but also has severely altered the groundwater regime in the park. Changes have occurred in groundwater quality and flow rates, which in turn have impacted vegetation, slope stability, soils, and water quality in the Snake River. Hydrologic models need to be updated based on on-going monitoring and research. Questions include: What changes are occurring in the groundwater flow regime? Are flow rates increasing and is groundwater quality decreasing? How are these changes affecting soils and caliche layers, surface water quality, slope stability, human safety, property, and facilities?

4. Wind Transport and Erosion

Wind erosion is a primary replenisher of fossils as lag deposits. This has several impacts to fossil resources. While exposing new fossils and allowing their collection, wind also exposes fossils to further erosion, exposure to sunlight, scattering by wind and water, and to theft. Wind can also cover fossil fragments and move them downslope from their original deposition site. As water dissolves the cementing material holding particles together, and landsliding loosens large areas of material, the wind will pick up and transport larger quantities of material. Also, agricultural practice to the west create clouds of wind blown material that is carried eastward over the park. This not only brings in more foreign material (e.g. topsoil, vegetation fragments), but also animal wastes, agricultural chemicals, pesticides, and exhaust emissions from equipment. Also, there may be radioactivity associated with some of the dust (see below). Monitoring question include: What is the nature of windblown material? How much herbicide, pesticide, and fertilizer is being suspended and transported? Are fossil sites being continuously monitored to determine the incremental effects of wind?

5. Minerals Issues/Abandoned Mineral Lands

Although there is no record of any outstanding unpatented mining claims in the monument, there is a history of gold placer mining along the Snake River in the Hagerman area. Miners used elemental mercury to amalgamate and extract the gold, often leaving mercury in waste rock and soil. There have been exploration and perhaps mining for uranium in the monument resulting in prospect pits that may have elevated radiation levels. Questions include: Is the park aware of the status of the mineral estate in the park? Are there private inholdings (surface estate), private minerals, split estates or patented mining claims. Are there state-owned lands or state submerged lands? Are there mineral leases? Is there potential for the development of mineral material (sand and gravel) extraction sites. Are there existing rights-of-way or easements (e.g. for the Bell Rapids Irrigation District) for pipelines, power lines, or roads that may present management issues. Are there any active, inactive, and/or abandoned mineral sites in the park? Does the park extract mineral materials for park maintenance or construction projects? Are all operations in compliance with all applicable laws, regulations, policies, and permits? How many AML sites are there within the park and have they been inventoried and plotted on a map?

6. Other Issues

Radioactivity: There is an occurrence of uranium and radium in the interbedded basalt flows. The uranium and radium has been preferentially taken up by fossil material, making them radioactive to the extent that precautions must be taken when handling and preparing fossils. Are there levels of radioactivity in the water? Is the radioactivity regional or local? What is the source of the radioactive elements? What process in the paleoenvironment deposited the minerals? Can the history of radioactivity help unlock the fossil ‘story’ at Hagerman?

Geothermal activity: Most of the active geothermal development is at the south end and mostly outside the park. There is a possibility that water wells drilled in the monument may have elevated temperatures. How much monitoring is there of geothermal wells, in terms of temperature, flow rates, associated gases and water quality? How and where is the spent geothermal water being disposed: on the surface, in stream channels, or is it being reinjected?

Visitors center siting: A museum and research center is planned for a 54-acre parcel on the east side of the Snake River. Tailings from prior mining activities remain on the site as well as contamination from hydrocarbon spills adjacent to the property. Questions requiring monitoring and research include: How has the soil been impacted by contamination? Is the site in a 100-year flood plain, and if so, what steps have been taken to protect the center from flooding? What is the groundwater level and quality? Will contaminants affect the new water supply well for staff and visitors?

Human industrial activity: The Hagerman Valley is the site of various activities including agriculture, forestry, fisheries, electric power plants, wine production, meat by-product processing, livestock trucking, dairy farming, and tourism. Both state and national fish hatcheries are major industries in the area. There are four hydroelectric plants in the area. What are the impacts of these industries on water quality and water flow? How are wastes products from these industries being disposed?

Scoping Meeting Participants

Sid Covington	Geologist	NPS, Geologic Resources Division
Marsha Davis	Geologist	NPS-Pacific-West Region
Neal Farmer	Natural Resource Specialist	Hagerman Fossil Beds NM
Pat Ferrell	Geologist Researcher	University of Idaho
Lisa Garrett	Network I&M Coordinator	NPS, University of Idaho
Phil Gensler	Paleontologist	Hagerman Fossil Beds NM
Virginia Gillerman	Research Geologist	Idaho Geological Survey
Fran Gruchy	Chief of Operations	Hagerman Fossil Beds NM
Gary Johnson	Assoc. Professor of Geology	University of Idaho
Bob Lorkowski	Geologist	Volunteer
Greg McDonald	Paleontologist	NPS, Geologic Resources Division
Anne Poole	Geologist	NPS, Geologic Resources Division
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Allan Wylie	Hydrologist	University of Idaho

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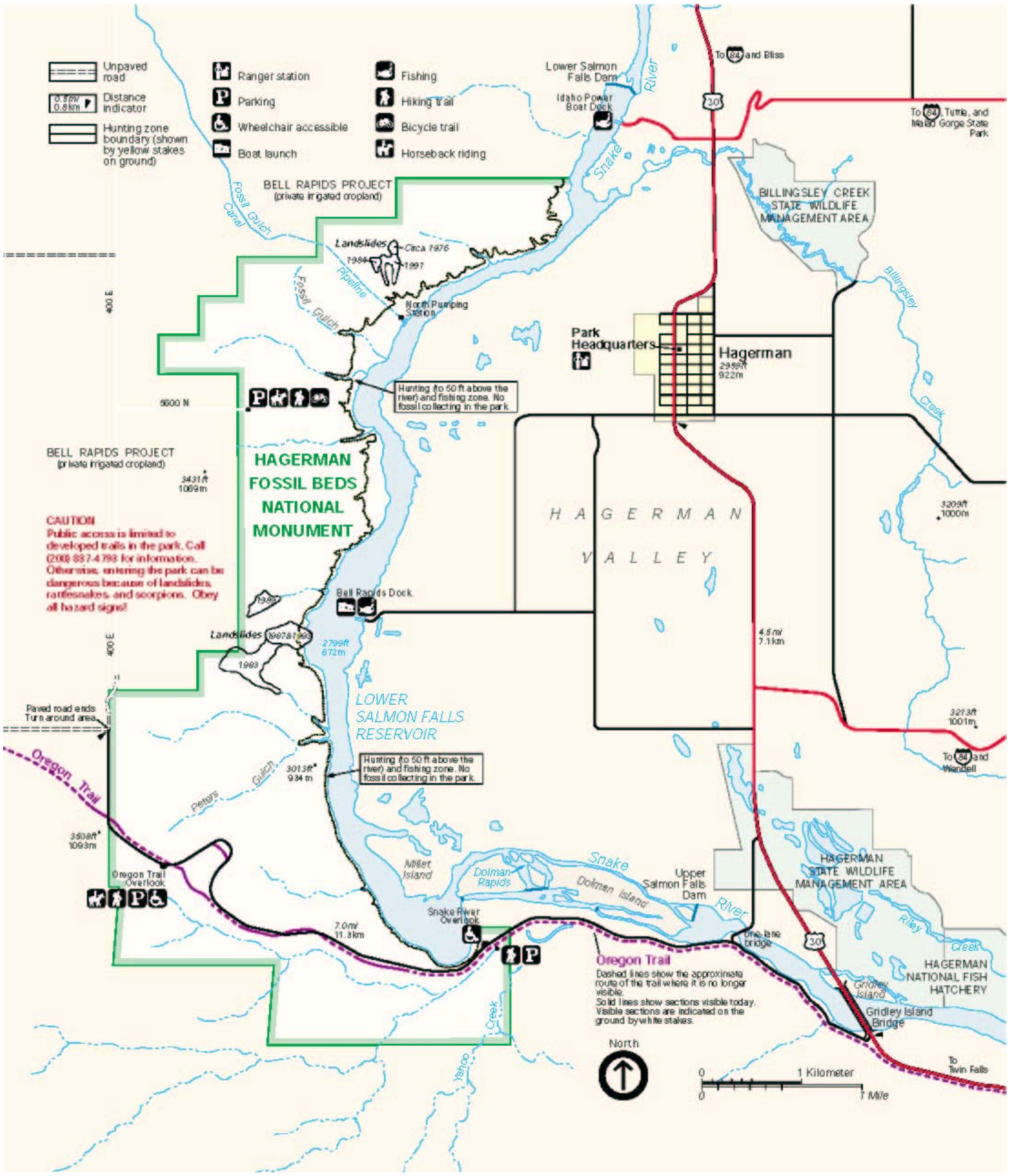

Unpaved road
0.5mi 0.8km
Distance indicator
Hunting zone boundary (shown by yellow stakes on ground)
Ranger station
Parking
Wheelchair accessible
Boat launch
Fishing
Hiking trail
Bicycle trail
Horseback riding
Lower Salmon Falls Dam
Idaho Power Boat Dock
To 84 and Bliss
30
To 84, Tuttle, and Malad Gorge State Park
Snake River
BELL RAPIDS PROJECT
(private irrigated cropland)
Fossil Gulch Canal
BILLINGSLEY CREEK STATE WILDLIFE MANAGEMENT AREA
Landslides
Circa 1976
1984
1997
Pipeline
Fossil Gulch
North Pumping Station
400 E
Park Headquarters
Hagerman
2959ft
922m
Billingsley Creek
Hunting (to 50 ft above the river) and fishing zone. No fossil collecting in the park.
5600 N
BELL RAPIDS PROJECT
(private irrigated cropland)
3431ft
1069m
HAGERMAN FOSSIL BEDS NATIONAL MONUMENT
H A G E R M A N
V A L L E Y
3209ft
1000m
CAUTION
Public access is limited to developed trails in the park. Call (208) 837-4793 for information. Otherwise, entering the park can be dangerous because of landslides, rattlesnakes, and scorpions. Obey all hazard signs!
Bell Rapids Dock
1983
Landslides
1987
1993
2799ft
872m
4.5mi
7.1km
400 E
1983
LOWER SALMON FALLS RESERVOIR
Paved road ends
Turn around area
3213ft
1001m
To 84 and Wendell
Oregon Trail
Hunting (to 50 ft above the river) and fishing zone. No fossil collecting in the park.
Peters Gulch
3013ft
934m
3508ft
1093m
Millet Island
Snake
Dolman Rapids
Dolman Island
Upper Salmon Falls Dam
River
HAGERMAN STATE WILDLIFE MANAGEMENT AREA
Oregon Trail Overlook
Riley Creek
7.0mi
11.3km
Snake River Overlook
One-lane bridge
30
Oregon Trail
Dashed lines show the approximate route of the trail where it is no longer visible.
Solid lines show sections visible today. Visible sections are indicated on the ground by white stakes.
HAGERMAN NATIONAL FISH HATCHERY
Gridley Island
Gridley Island Bridge
Yahoo Creek
North
0
1 Kilometer
0
1 Mile
To Twin Falls